MARKED-UP COPY OF ORIGINALLY-FILED SPECIFICATION

DIRECTORY SERVER SYSTEM FOR STORING

~~PAST-HISTORY INFORMATIONS~~ HISTORY INFORMATION

5

BACKGROUND OF THE INVENTION

The present invention relates to a directory server system for storing ~~past-history informations~~ history information, and more particularly to a directory server system for ~~an extension~~

10 ~~of~~ extending a service interface to users.

The conventional directory server system ~~enables the users~~ allows a user to ~~avail informations~~ access information about present or current states of users and ~~equipments~~ equipment registered on the server. Namely, the conventional directory

15 server system stores only ~~the informations~~ information about present or current states of users and ~~equipments~~ equipment registered on the server. The ~~users~~ user is unable to obtain the ~~past-history~~ history about the states of the registered users or ~~equipments~~ equipment and also is unable to confirm the exact

20 renewal dates.

In the above circumstances, it had been required to develop a novel directory server system free from the above problem.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a novel directory server system free from the above problems.

5   It is a further object of the present invention to provide a novel[[.]] directory server system for storing ~~past-history~~ history about the states of the registered users or ~~equipments~~ equipment.

It is a still further object of the present invention to provide a novel directory server system for storing the exact renewal dates of the states.

It is yet a further object of the present invention to provide a novel directory server system for providing renewed ~~informations~~ information about ~~past-history~~ history of the states of the registered users or ~~equipments~~ equipment.

The present invention provides a directory server system ~~comprising :~~ that includes a directory server for storing an attribute of an entry[[;]], an entity monitor ~~being~~ connected to the directory server for monitoring an entity[[,]] so that if a change in a state of the entity appears, ~~then~~ the entity monitor instructs the directory server to renew an attribute of a corresponding entry to the entity[[;]], and a directory renewal history storage device ~~being~~ connected to the directory server for storing a renewed attribute of the entry as attribute renewal history ~~informations~~ information.

2

The above and other objects, features and advantages of the present invention will be apparent from the following ~~descriptions~~ description.

5   BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments according to the present invention will be described in detail with reference to the accompanying drawings.

FIG. 1 is a block diagram illustrative of a structure

10 of a novel directory server system in a first embodiment in accordance with the present invention.

DISCLOSURE OF THE INVENTION

The present invention provides a directory server system

15 ~~comprising :~~ that includes a directory server for storing an attribute of an entry[[;]], an entity monitor ~~being~~ connected to the directory server for monitoring an entity[[,]] so that if a change in a state of the entity appears, ~~then~~ the entity monitor instructs the directory server to renew an attribute of

20 a corresponding entry to the entity[[;]], and a directory renewal history storage device ~~being~~ connected to the directory server for storing a renewed attribute of the entry as attribute renewal history ~~informations~~ information.

It is preferable to further ~~comprise~~ include a

25 time-correspondent directory server connected to both the

directory server and the directory renewal history storage device

for confirming an existence of a target entry on the directory

server, so that if the existence of the target entry on the directory

server could be confirmed, then the time-correspondent directory

5   server obtains the attribute renewal history ~~informations~~

information from the directory renewal history storage device.

It is preferable to ~~further more comprise~~ furthermore

include a directory purging entry storage device ~~being~~ connected

to the directory server, the directory renewal history storage

10   device and the time-correspondent directory server for storing

an entry corresponding to an absent entity which has become ~~absent,~~

~~whilst the entry becomes absent on~~ from the directory server.

It is moreover preferable that if the entity becomes absent,

then the attribute renewal history ~~informations~~ information of

15   a corresponding entry to the absent entity ~~are~~ is deleted from

the directory renewal history storage device, and in place the

directory purging entry storage device stores the attribute

renewal history ~~informations~~ information.

It is preferable to ~~further~~ moreover ~~comprise~~ include

20   a time-correspondent directory client connected to the

time-correspondent directory server for sending the

time-correspondent directory server a request for obtaining

attribute history ~~informations~~ information at a past time of an

entry from the time-correspondent directory server in order to

25   refer the attribute history ~~informations~~ information at the past

4

time.

It is also preferable that if the request from the time-correspondent directory client is free of any access right, then the time-correspondent directory server rejects the request and sends the time-correspondent directory client a notice to the effect that the request is illegal.

It is preferable to further ~~comprise~~ include a time-correspondent directory client connected to the time-correspondent directory server for sending the time-correspondent directory server a request for obtaining attribute history ~~informations~~ information during a past time period of an entry from the time-correspondent directory server in order to refer the attribute history ~~informations~~ information during the past time period.

It is ~~further more~~ furthermore preferable that if the request from the time-correspondent directory client is free of any access right, then the time-correspondent directory server rejects the request and sends the time-correspondent directory client a notice to the effect that the request is illegal.

It is also preferable that the directory renewal history storage device also stores renewal time and date together with the renewed attribute of the entry as attribute renewal history ~~informations~~ information.

PREFERRED EMBODIMENT

A first embodiment according to the present invention will be described in detail with reference to the drawings. FIG. 1 is a block diagram illustrative of a structure of a novel directory server system in a first embodiment in accordance with the present invention. The novel directory server system has the following ~~structures~~ structure. A directory server 1 is provided for storing attribute ~~informations~~ information of entries. An entity status monitor 2 is connected to the directory server 1 for monitoring the change of states of the entity 7 which corresponds to registered users or ~~equipments~~ equipment, so that the entity status monitor 2 renews the attribute ~~informations~~ information of the entries stored in the directory server 1 upon change of the states of the entity 7. A directory renewal-history storage device 3 is connected to the directory server 1 for storing renewal dates and renewed ~~contents~~ content of the directory server 1. A directory purging entry storage device 6 is connected to both the directory server 1 and the directory renewal-history storage device 3 for storing all of the attribute renewal ~~past-history informations~~ history information for an absent entry on the directory server 1, wherein the absent entry corresponds to the past-entity 7 which is currently absent. A time-correspondent directory server 4 is connected to the directory server 1, the directory renewal-history storage device 3 and the directory purging entry storage device 6 for generating [[an]] attribute renewal history information.

A time-correspondent directory client 5 is connected to the time-correspondent directory server 4 for obtaining the attribute renewal history information from the time-correspondent directory ~~client 5~~ server 4 and displaying the same.

5   ~~Operations~~ Operation of the above novel directory server system will be described. The entity status monitor 2 continuously or periodically monitors the service state of the entity 7. If any change in the service state of the entity 7 appears, then the attribute of the entry corresponding to the entity 7 is renewed

10 by the directory server 1, wherein the entry is stored in the directory server 1. The directory server 1 sends the renewal date and the renewed contents to the directory renewal-history storage device 3, so that the directory renewal-history storage device 3 stores the renewal date and the renewed contents.

15   The time-correspondent directory client 5 sends the time-correspondent directory server 4 a request for the ~~past-state~~ past state of the entry on the ~~director~~ directory server 1, so that the time-correspondent directory server 4 couples the information from the directory server 1 to the information from

20 the directory renewal-history storage device 3 for sending only the requested information about the ~~past-state~~ past state of the entry, whereby the time-correspondent directory client 5 receives the ~~past-state~~ past state of the entry from the time-correspondent directory server 4.

25

The following ~~descriptions~~ <u>description</u> will focus on the detailed ~~operations~~ <u>operation</u> of the above directory ~~sever~~ <u>server</u> system. The entity status monitor 2 receives [[the]] information about <u>a</u> change of the state of the entity 7. The entity status monitor 2 instructs the directory server 1 to renew the attribute information of the entry corresponding to the entity 7, wherein the entry exists on the directory server 1. The renewed information on the directory server 1 is sent to the directory renewal-history storage device 3 and stored in the directory renewal-history storage device 3.

If the entity 7 becomes absent, then the entity status monitor 2 instructs the directory server 1 to send the directory purging entry storage device 6 the entry corresponding to the entity 7, whereby the entry is deleted from the directory server 1, so that the directory purging entry storage device 6 ~~serves~~ <u>stores</u> the entry. Further, the directory purging entry storage device 6 obtains all attribute renewal history ~~informations~~ <u>information</u> of the target entry from the directory renewal-history storage device 3 in order to store [[the]] all <u>the</u> attribute renewal history ~~informations~~ <u>information</u>, wherein the history ~~informations~~ <u>information</u> of the target entry ~~are~~ <u>is</u> deleted from the directory renewal-history storage device 3.

The time-correspondent directory client 5 sends the time-correspondent directory server 4 a request for [[the]] information about a ~~past-state~~ <u>past state</u> at a ~~past-time~~ <u>past</u>

8

time of the entry on the directory server 1 or [[the]] information about change of the ~~past-state~~ past state in a ~~past-time~~ past time period. The time-correspondent directory server 4 receives this request from the time-correspondent directory client 5, so that the time-correspondent directory server 4 confirms whether or not the target entry currently exists in the ~~informations~~ information on the directory server 1. If the target entry exists, then the time-correspondent directory server 4 obtains the attribute renewal history information from the directory renewal-history storage device 3. If the target entry does not exist currently in the informations on the directory server 1, then the time-correspondent directory server 4 confirms whether or not the target entry exists in the directory purging entry storage device 6. If the target entry exists, then the time-correspondent directory server 4 obtains information of the purging entry from the directory purging entry storage device 6. After the time-correspondent directory server 4 has obtained the information, then the time-correspondent directory server 4 sends the time-correspondent directory client 5 the requested time-correspondent information.

If it is necessary to prepare the entry on the directory server 1 in correspondence with the entity 7 for the supervisor for supervising the change of the state or for the equipment, then the manager of the director server 1 sets the entity status monitor 2 so that the entity status monitor 2 monitors the state

9

change of the entity 7. The entry preparing information on the directory server 1 is stored as an initial state information of the entity 7 on the directory renewal-history storage device 3, wherein access rights are set to the individual entries of the

5   directory renewal-history storage device 3.

If the state change appears on the entity 7, then the entity status monitor 2 obtains the state change information and instructs the directory server 1 to renew the attribute information of the entry corresponding to the entity 7, wherein

10   the entry exists on the directory server 1, so that the attribute renewal information of the entry is stored in the directory renewal-history storage device 3.

If it is necessary to delete the entry on the directory server 1 in correspondence with the entity 7 for the supervisor

15   for supervising the state change or the equipment, then the manager for the directory server 1 releases the entity status monitor 2 from monitoring the state change information of the entity 7. The information of the entry deletion from the directory server 1 is stored in the directory renewal-history storage device 3

20   and concurrently the directory renewal-history storage device 3 sends the directory purging entry storage device 6 all of the attribute renewal history informations information of the target entry. The access right to the history information in the directory renewal-history storage device 3 is succeeded to the purging entry

25   on the directory purging entry storage device 6.

10

If ~~the~~ a directory service user wishes to know a ~~past state~~ past state at a ~~past time~~ past time of the entry on the directory server 1, then the directory service user operates the time-correspondent directory client 5 to send the time-correspondent directory server 4 a request for obtaining the information about the ~~past state~~ past state by utilizing a Search Request of LADP provided under the following RFC2251 of IETF. An "X-search At Time" attribute filter is additionally specified in response to Attribute value Assertion under Filter Equality Match Rule in order to designate the date and time of the search target of the search target entry, wherein "X-search At Time" accords to the syntax (1.3.6.1.4.1.1466.115.121.1.24 DESC 'Generalized Time').

The time-correspondent directory server 4 removes the "X-search At Time" from the received Search Request Filter to obtain the Search Request of LDAP, so that the time-correspondent directory server 4 utilizes the Search Request of LDAP in order to confirm the existence of the entry in the directory server 1. If the existence of the entry ~~could be~~ is confirmed, then the time-correspondent directory server 4 obtains the attribute renewal history information of the entry from the directory renewal-history storage device 3, so that the time-correspondent directory server 4 ~~form~~ forms attribute ~~informations~~ information at a time when the request is issued, in order to respond to the time-correspondent directory client 5. If the directory service

11

user has no access right to the attribute renewal history ~~informations~~ <u>information</u> of the entry, then the time-correspondent directory server 4 rejects the request and sends the time-correspondent directory client 5 an error response

5   which indicates that the request is illegal.

If the time-correspondent directory server 4 could not confirm the presence of the target entry on the directory server 1, then the time-correspondent directory server 4 attempts to confirm the presence of the target entry on the directory purging

10 entry storage device 6 in order to confirm whether or not the target entry has already been deleted from the directory server 1. If the target entry does not exist on the directory purging entry storage device 6 or if the directory service user has no access right, then the time-correspondent directory server 4

15 rejects the request and sends the time-correspondent directory client 5 an error response which indicates that the request is illegal. If the target entry is present on the directory server 1, then the time-correspondent directory server 4 obtains the attribute renewal history information of this entry, so that the

20 time-correspondent directory server 4 ~~form~~ <u>forms</u> attribute ~~informations~~ <u>information</u> at a time when the request is issued, in order to respond to the time-correspondent directory client 5. If the entry has been deleted at the time when the request was issued, then the time-correspondent directory server 4 sends

25 the time-correspondent directory client 5 both a notice to the

12

effect that the entry has already been deleted and a final state of the entry.

If ~~the~~ a directory service user wishes to know a past state history during a ~~past-time~~ past time period of the entry on the directory server 1, then the directory service user operates the time-correspondent directory client 5 to send the time-correspondent directory server 4 a request for obtaining the information about the past state history by utilizing a Search Request of LADP provided under the following RFC2251 of IETF. Both an "X-search Start Time" attribute filter and an "X-search End Time" attribute filter are additionally specified in response to Attribute value Assertion under Filter Equality Match Rule in order to designate both the start date and time of starting the search target of the search target entry and the end date and time of ending the search target of the search target entry, wherein "X-search At Time" and "X-search End Time" accord to the syntax (1.3.6.1.4.1.1466.115.121.1.24 DESC 'Generalized Time').

The time-correspondent directory server 4 removes the "X-search Start Time" and "X-search End Time" from the received Search Request Filter to obtain the Search Request of LDAP, so that the time-correspondent directory server 4 utilizes the Search Request of LDAP in order to confirm the existence of the entry in the directory server 1. If the existence of the entry could be confirmed, then the time-correspondent directory server 4 obtains the attribute renewal history information of the entry

13

from the directory renewal-history storage device 3, so that the time-correspondent directory server 4 ~~form~~ forms attribute ~~informations~~ information at the started time of the requested time period and a post attribute renewal history information,

5 in order to respond to the time-correspondent directory client 5. If the directory service user has no access right to the attribute renewal history ~~informations~~ information of the entry, then the time-correspondent directory server 4 rejects the request and sends the time-correspondent directory client 5 an error response

10 which indicates that the request is illegal.

If the time-correspondent directory server 4 could not confirm the presence of the target entry on the directory server 1, then the time-correspondent directory server 4 attempts to confirm the presence of the target entry on the directory purging

15 entry storage device 6 in order to confirm whether or not the target entry has already been deleted from the directory server 1. If the target entry does not exist on the directory purging entry storage device 6 or if the directory service user has no access right, then the time-correspondent directory server 4

20 rejects the request and sends the time-correspondent directory client 5 an error response which indicates that the request is illegal. If the target entry is present on the directory server 1, then the time-correspondent directory server 4 obtains the attribute renewal history information of this entry, so that the

25 time-correspondent directory server 4 ~~form~~ forms attribute

14

~~informations of~~ <u>information for</u> the requested time period and the attribute renewal history information, in order to respond to the time-correspondent directory client 5. If the entry has been deleted before the requested time period, then the

5   time-correspondent directory server 4 sends the time-correspondent directory client 5 both a notice to the effect that the entry has already been deleted and a final state of the entry.

    Accordingly, the above described novel directory server

10   system ~~enables~~ <u>allows</u> the user to operate the time-correspondent directory client to refer the attribute renewal history information on the renewed directory server 1, thereby obtaining the past-entry on the ~~director~~ <u>directory</u> server 1 and the informations about the status changes of the person or equipment

15   which corresponds to the entry.

    Whereas modifications of the present invention will be apparent to a person having ordinary skill in the art, to which the invention pertains, it is to be understood that embodiments as shown and described by way of illustrations are by no means

20   intended to be considered in a limiting sense. Accordingly, it is to be intended to cover by claims all modifications which fall within the spirit and scope of the present invention.

15